

UNITED STATES PATENT APPLICATION

OF

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FOR

DISHWASHER

[0001] This application claims the benefit of Korean Application(s) No. 10-2002-0074994 filed on November 28, 2002 which is/are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

5 Field of the Invention

[0002] The present invention relates to a dishwasher, and more particularly, to a valve assembly for supplying water to a dishwasher.

Discussion of the Related Art

10 [0003] Generally, a dishwasher is an apparatus for cleaning tableware held therein by injecting water. An inlet passage connected to an external water supply source extends into a dishwasher to supply water, and an inlet valve assembly is installed at the inlet passage. Moreover, an outlet pump and an outlet passage are installed in the dishwasher to discharge the water.

15 [0004] Meanwhile, water may leak from various parts inside due to various reasons while the dishwasher operates. Specifically, it is highly probable that the water may leak from the inlet passage or the inlet valve assembly. For instance, the failure of the inlet valve assembly may excessively supply water to overflow from a tub. The water may keep leaking to flow in electric devices of the dishwasher, thereby causing failure or malfunctions to the electric devices or electric shock or fire due to a short circuit. Furthermore, if the water is not
20 cut off by the inlet passage or the inlet valve assembly, the continuous leakage of water out of the dishwasher may extend to other electric home appliances, thereby causing failure of the home appliances or bringing about danger of electric shock or fire.

SUMMARY OF THE INVENTION

[0005] Accordingly, the present invention is directed to a dishwasher that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

5 [0006] An object of the present invention, which has been devised to solve the foregoing problem, lies in providing a dishwasher, by which further water leakage is prevented in case of water leakage.

[0007] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art
10 upon examination of the following or may be learned from a practice of the invention. The objectives and other advantages of the invention will be realized and attained by the subject matter particularly pointed out in the specification and claims hereof as well as in the appended drawings.

[0008] To achieve these objects and other advantages in accordance with the present
15 invention, as embodied and broadly described herein, there is provided a dishwasher including a housing, a tub in the housing to hold tableware, an injector assembly for injecting water on the tableware in the tub, and an inlet valve assembly including a case installed at an inlet passage for supplying the water to the tub, the case having an inlet opening via which the water flows in and an outlet opening via which the water is discharged, a first valve provided
20 to the case to selectively open/close a passage in the case, and a second valve closing the passage in the case in case that the water leaks.

[0009] The first valve selectively opens/closes the inlet opening. And, the second valve closes the outlet opening.

[0010] The second valve includes a diaphragm installed at the passage and a pressing

mechanism floated by the leaking water to press the diaphragm to close the passage.

[0011] And, the pressing mechanism includes a float configured to be floated by the leaking water and a plunger separated from the float to press the diaphragm if the float is floated.

5 [0012] Preferably, the plunger is attached to or detached from the float according to a distance from the float. For this, the pressing mechanism further includes a magnet detaching the plunger from the magnet according to a distance from the plunger in the case.

[0013] The float is guided by a guide provided on a base panel of the housing. And, the case includes a holder guiding a movement of the float.

10 [0014] The float includes a body floated by the leaking water and an extension member extending from the body to be adjacent to the plunger in the case.

[0015] The extension member includes a rod installed at the body and an arm extending from the rod to be adjacent to the plunger.

15 [0016] Preferably, the arm is movably installed at the rod and the magnet is installed at the arm.

[0017] Preferably, the rod includes a step supporting the arm. More preferably, the rod includes a plurality of steps to install the arm at a predetermined portion of the rod selectively.

20 [0018] Therefore, the present invention stops the additional leakage of the water, thereby preventing failure of the dishwasher and accident caused by a short circuit.

[0019] It is to be understood that both the foregoing explanation and the following detailed description of the present invention are exemplary and illustrative and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0021] FIG. 1 is a perspective view of a dishwasher according to the present invention;

[0022] FIG. 2 is a cross-sectional view of a dishwasher according to the present invention; and

[0023] FIG. 3 is a perspective view of a disassembled inlet valve assembly of a dishwasher according to the present invention;

[0024] FIG. 4 is a perspective view of a dishwasher according to the present invention; and

[0025] FIG. 5A and FIG. 5B are cross-sectional views of a dishwasher according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0026] Reference will now be made in detail to the preferred embodiment(s) of the present invention, examples of which are illustrated in the accompanying drawings. Throughout the drawings, like elements are indicated using the same or similar reference designations where possible.

[0027] FIG. 1 is a perspective view of a dishwasher according to the present invention and FIG. 2 is a cross-sectional view of a dishwasher according to the present invention.

[0028] Referring to FIG. 1 and FIG. 2, a dishwasher according to the present invention basically includes a housing 10 and a tub 20, a rack 30, and an injector assembly 40 installed in the housing 10.

[0029] The housing 10 is designed to install to protect various equipments inside. A door 11 is installed at a front side of the housing 10 to open/close an entrance of the tub 20, and a user puts or pulls tableware in or out of the tub 20 via the entrance. A fan 11a is installed at the door 11 to blow air for drying the washed tableware.

[0030] The tub 20 provides a space for holding the tableware to be washed. The rack 30 is installed in the tub 20 and a plurality of tableware are arranged on the rack 30 to leave a distance appropriate for washing. The rack 30 is constructed to enable to discharge water smoothly, and is detachably installed on a sidewall of the tub 20 to be conveniently put in or drawn out of the tub 20.

[0031] The injector assembly 40 is constructed to inject water onto the tableware. Specifically, the injector assembly 40 includes a nozzle 41 installed in the tub 20, a sump 42 communicating with the nozzle 41, and a pump 43. The nozzle 41 is connected to the sump 42 by a connecting pipe 41a. Preferably, the nozzle 41 is rotatably installed in the tub 20 to evenly inject the water on the tableware. The sump 42 is installed under the tub 20, and preliminarily stores the water to supply to the nozzle 41 uniformly. And, the pump 43 is installed in the vicinity of the sump 42, and pumps up the water in the sump 42 to the nozzle 41 for injection of the water.

[0032] Moreover, a water supply equipment 50 for supplying water to the sump 42 and a drain equipment 60 for discharging the used water are installed in the dishwasher. The water supply equipment 50 includes an inlet passage 51 and a valve assembly 100 installed at the inlet passage 51. The inlet passage 51 is connected to the sump 42 and extends to an

eternal water supply source through the housing 10. The valve assembly 100 selectively opens or cuts off the inlet passage 51. Once the valve assembly 100 is turned on, the water is supplied to the sump 42 from the water supply source via the inlet passage 51. Moreover, the drain equipment 60 includes a drain passage 61 and a pump 62 communicating with the drain
5 passage 61. Specifically, the drain passage 61 is connected to the sump 42, and extends outside the dishwasher via the pump 62. The water used in washing is stored in the sump 42 and is repeatedly injected onto the tableware by the injector assembly 40. After completion of washing, once the pump 62 is driven, the used water is discharged outside the dishwasher via the drain passage 61.

10 **[0033]** In order to prevent the failure and malfunction of the dishwasher due to the water leakage thereof, additional water leakage should be prevented. As explained in the foregoing description, the inlet valve assembly 100 selectively opens/closes the inlet passage 51, thereby substantially controlling the supply of water in the dishwasher. Hence, the inlet valve assembly 100 according to the present invention is configured to prevent the additional
15 water leakage, and such an inlet valve assembly is explained in detail as follows.

[0034] FIG. 3 is a perspective view of a disassembled inlet valve assembly of a dishwasher according to the present invention, FIG. 4 is a perspective view of a dishwasher according to the present invention, and FIG. 5A and FIG. 5B are cross-sectional views of a dishwasher according to the present invention.

20 **[0035]** Referring to FIG. 3, an inlet valve assembly 100 is disposed in a lower part of the dishwasher. Specifically, the inlet valve assembly 100 is installed between a base panel 11 of the housing 10 and the tub 20. The inlet valve assembly 100 is installed at a lower part of a rear panel 12 of the housing 10 using a coupling member. And, the inlet valve assembly 100 mainly includes a case 110 and first and second valve 120 and 130 installed in the case 110.

[0036] The case 110 includes an inlet opening 111 via which water flows in and an outlet opening 112 via which the flowing-in water is discharged. The outlet and inlet openings 112 and 111 are provided to the case 110 to lie inside and outside the rear panel 12, respectively. A predetermined passage is formed inside the case 110 for controlling a flow of water. A partition wall 113, as shown in FIG. 5B, is formed in the case 110 to enclose a periphery of the outlet opening 112. Hence, the water, which is indicated by arrows in the drawing, detours the partition wall 113 to flow to the first valve 120 via the inlet opening 111, and then flows to the outlet opening 112 via the passage between the second valve 130 and the partition wall 113.

[0037] The first valve 120 is installed in the case 110 to control the supply of water. For this, the first valve 120 is configured to selectively open/close the passage in the case 110, and substantially, the neighboring inlet opening 111. The first valve 120, as shown in FIGs. 5A to 5C, includes a diaphragm 121, a plunger 122 near the diaphragm 121, and a solenoid 123. The diaphragm 121 is installed on the passage in the vicinity of the inlet opening 111. The plunger 122 supported by a spring 124 presses the diaphragm 121. Namely, the diaphragm 121 is pushed to adhere closely to the passage by the plunger 122 to close the passage. The solenoid 123 is installed around the plunger 122 to leave a predetermined distance. When a current is applied to the solenoid 123, the solenoid 123 generates a magnetic field to pull the plunger 122 not to press the diaphragm 121. Hence, once the current is applied to the solenoid 123 by a controller (not shown in the drawing) controlling an operation of the dishwasher, the generated magnetic field enables the plunger 122 to overcome the elastic force of the spring 124 to release the diaphragm 121. Thereafter, the diaphragm 121 opens the passage by a water pressure so that water starts to be supplied to the dishwasher.

[0038] The second valve 130 is configured to close the passage in the case 110 if water leaks. Specifically, if a predetermined amount of water leaks on the base panel 11, the second valve 120 substantially closes the neighboring outlet opening 112. The second valve 130, as shown in FIG. 4 to FIG. 5C, includes a diaphragm 131 and a pressing mechanism
5 configured to press the diaphragm 131. The diaphragm 131 is installed at the passage in the vicinity of the outlet opening 112. Moreover, the pressing mechanism floats on the leaking water to press the diaphragm 131 to close the passage. Such a pressing mechanism is explained in detail as follows.

[0039] The pressing mechanism includes a float configured to be floated by the
10 leaking water and a plunger 133 configured to press the diaphragm 131 by the floated float 132. The plunger 133 enables to press the diaphragm 131 in various ways related to the floatage of the float 132. In the present invention, the plunger 133 is separated from the floated float 132 to press the diaphragm 131. Such a method is preferable because the configuration of the relating valve assembly is simplified. Moreover, the float 132 ascends or
15 descends so that a relative distance between the float 131 and the plunger 133 is variable. Hence, such a variable distance facilitates to control the separation of the plunger 133. For this, the pressing mechanism further includes a magnet 134 generating a magnetic field attracting the plunger 133. The magnet 134 is installed at the float 131 in the vicinity of the plunger 133, whereas the plunger 133 is installed in the case 110 in the vicinity of the
20 diaphragm 131 to be movable. Hence, if there is no leakage of water, the plunger 133 is attracted to the adjacent magnet 134 so as not to press the diaphragm 131. On the other hand, once the magnet 134 is separated by the floatage of the float, the plunger 133 is separated from the magnet 134 to press the adjacent diaphragm 131. Hence, the magnet 134 separates the plunger 133 according to the distance from the plunger 133.

[0040] The float 132 is configured to be substantially floated by the water leaking on the base panel 11. Specifically, the float 132 includes a body 132a floated by the leaking water and an extension member extending from the body 132a to be adjacent to the plunger 133.

[0041] The body 132a of the float 132 lies on the base panel 11 and is floated by the water leaking on the base panel 11. The body 132a is substantially a disc type and is formed of a lightweight material such as Styrofoam and the like. Moreover, the body 132a is installed between a plurality of guides 11a protruding from the base panel 11, and is guided by the guides 11a to stably move upward and downward. Namely, the guides 11a substantially lead the overall movement of the float 132.

[0042] The extension member includes a rod 132b installed at the body 132a and an arm 132c extending from the rod 132b. The magnet 134 is installed at the extension member to be in the vicinity of the plunger 133. First of all, the rod 132b extends vertically from a center of the body 132a. The rod 132b, as well shown in FIG. 4, is installed to penetrate a first holder 114a provided in the case 110, thereby being guided by the first holder 114a on moving upward and downward. The first holder 114a substantially has a hole of which diameter is greater than that of the rod 132b so as to be penetrated by the rod 132b. The arm 132c extends to the plunger 133 from the rod 132b and is then bent to be adjacent to the plunger 133. The magnet 134 is substantially installed at the arm 132c of the extension member. A second holder 114b is installed on a top of the case 110 and includes a hole in which the bent portion of the arm 132c is inserted. An opening 114c is formed at a side of the second holder 114b, and the bent portion is easily loaded in or unloaded from the second holder 114b via the opening 114c. The bent portion is guided by the second holder 11b, whereby the float 132 as well as the arm 132c enables to stably move upward and downward overall.

[0043] Specifically, a first end 132e of the arm 132c is installed at the rod 132b

movably and detachably. For this, the first end 132e, as shown in FIG. 4, has an open ring shape of which one portion is cut away so as to be elastically deformed to be freely detachable from the rod 132b. Moreover, a step 132d is formed at the rod 132b to support the attached first end 132e stably. Preferably, a plurality of steps 132d can be formed at the rod
 5 132b to leave a predetermined interval from each other. The steps 132d divide the rod 132b into a plurality of sections, and the first end 132e is loaded at one of the sections. Namely, the steps 132d enable the arm 132c to be selectively loaded on a demanded position at the rod 132b. Hence, the arm 132c is movably installed at the rod 132b to adjust a distance between the magnet 134 and the plunger 133. Such a distance adjustment enables to control an
 10 operational sensitivity of the second valve 130. For instance, when the first end 132e is relatively installed at an upper part of the rod 32b, the magnet 134 relatively gets far from the plunger 133. Hence, even if the float 132 floats a little, the plunger 133 is released from the magnet 134 to press the diaphragm 131. Namely, despite a small amount of the leaking water, the second valve 130 is turned off to close the passage. Meanwhile, a plurality of hooks are
 15 provided to a second end 132f of the arm 132c so that the magnet 134 can be stably installed at the second end 132f by the hooks.

[0044] An operation of the dishwasher according to the present invention is explained by referring to the relating drawings as follows.

[0045] First of all, the water is not supplied to the dishwasher via the valve assembly
 20 100 and the inlet passage 51 until the dishwasher operates. The plunger 122 of the first valve 120, as shown in FIG. 5A, presses the diaphragm 121 by the elastic force of the spring 124, and the pressed diaphragm 121 then closes the passage in the vicinity of the inlet opening 111. As the inlet opening 111 is substantially closed by the first valve 120, the water is unable to pass the valve assembly 100 to be supplied to the dishwasher.

[0046] Once a user starts to operate the dishwasher, the controller of the dishwasher executes a water supply according to a setup washing course. Namely, a current is applied to the solenoid 123 of the first valve 120 by the controller. A magnetic field appearing around the solenoid 123 enables the plunger 122, as shown in FIG. 5B, to overcome the elastic force of the spring 123 to be drawn toward the solenoid 123. Simultaneously, as the force pressing the diaphragm 121 is released, the diaphragm 121 is pulled by the water pressure to open the inlet opening 111.

[0047] Moreover, in the second valve 130, since the distance between the plunger 133 and the magnet 134 is short, the plunger 133 is attached to the magnet 134 by interposing the case 110 therebetween. Hence, the plunger 133 fails to press the diaphragm 131 so that the outlet opening 112 is kept open as well.

[0048] As both of the inlet and outlet openings 111 and 112 are open, the water is supplied to the sump 42 via the valve assembly 100 and the inlet passage 51.

[0049] Referring to FIG. 2, the supplied water is pumped up by the pump 43 and is then injected onto the tableware in the rack 30 via the nozzle 41. Thus, the tableware is washed by the injected water. In the process of washing the tableware, excessive water supply or failure of the inlet passage 51 or valve assembly 100 may cause the leakage of the water. And, the leaking water gathers on the base panel 11. Since the dishwasher keeps washing, the plunger 122 of the first valve 120, as shown in FIG. 5B, fails to press the diaphragm 121 thereof so that the inlet opening 11 keeps open.

[0050] Yet, in the second valve 130, the body 132a is floated by the leaking water as soon as the rod 132b and the arm 132c ascend together with the magnet 134. The plunger 133 gets away from the magnet 134 by such an ascending movement to deviate from an effective range of the magnetic field of the magnet 134, thereby being separated from the magnet 134

to move downward by gravity. Hence, the plunger 133 presses the diaphragm 131 to close the outlet opening 112.

[0051] As the inlet opening 111 and the outlet opening 112 are open and closed, respectively, the water is not supplied to the dishwasher any more. Hence, the water is prevented from leaking in addition.

[0052] Consequently, the valve assembly according to the present invention utilizes a mechanism and enables to independently stop supplying water without interworking with other peripheral devices when the water leakage takes place. Therefore, the valve assembly according to the present invention is directly applicable to other home appliances using water such as a washing machine and the like without modification.

[0053] Accordingly, the dishwasher according to the present invention has the following advantages or effects.

[0054] First of all, the inlet valve assembly includes the second valve operating to close the internal passage using the leaking water. Moreover, the second valve enables to independently stop supplying the water, thereby stably preventing additional water leakage when the water leaks. Therefore, the present invention prevents accidents such as an electric shock, fire etc., as well as failures or malfunctions of electric devices, thereby enhancing its stability, reliance, and safety.

[0055] Moreover, the second valve mechanically operates using the float, magnet, and the like, whereby the valve assembly is simply configured. And, the mechanical second valve enables the valve assembly to operate to stop supplying the water more accurately than other electronic mechanisms affected by the leaking water. Therefore, the present invention reduces a product cost and enhances reliance more.

[0056] It will be apparent to those skilled in the art that various modifications and

variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover such modifications and variations, provided they come within the scope of the appended claims and their equivalents.